© Academy of Management Journal
1990, Vol. 33, No. 3, 503–519.

FORMS OF INTERORGANIZATIONAL GOVERNANCE FOR MULTINATIONAL ALLIANCES

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This study drew upon complementary work in transaction cost economics, organization theory, and international corporate strategy studies to examine governance forms for multinational alliances. An analysis of 153 new alliances suggested that the selection of a contractual agreement or a joint venture as a form of governance was influenced by the intent to conduct R&D and the technological intensity of the alliance's product area alone and in interactive combination with the size of the parent firms.

Multinational firm alliances are being touted as critical mechanisms for competing in global markets and coping with the increasingly rapid pace of technological development (Ghoshal, 1987; Harrigan, 1987). Yet, although the number of international cooperations appears to be increasing dramatically (Auster, 1987; Hergert & Morris, 1988), they are notoriously unstable, prone to failure, and at best, difficult to govern (Morris & Hergert, 1987; Pucik, 1987). Prior work has suggested that the governance form chosen for these alliances may be particularly important in influencing their success and their ability to meet the objectives of the participating firms (Harrigan, 1988; Rugman, 1981).

The purpose of this study was to provide an empirical analysis of some factors underlying the choice of interorganizational governance form made in newly formed multinational cooperative relationships. We examined joint ventures, which involve creating a new legal entity with shared equity, and contractual agreements that do not involve shared equity, such as licensing, distribution, technical assistance, supply, and marketing agreements, as alternative governance modes. Both joint ventures and contractual agreements are commonly used to exchange technology, products, and services across national and firm boundaries (Harrigan, 1987; Hennart, 1988; Porter, 1986).

Preparation of this manuscript was supported by a grant from the National Science Foundation (No. SES-8504397), Richard N. Osborn, Jon Olson, and Mitsuyo Hanada, co-principal investigators. The authors want to express their appreciation to G. Astley, R. Zammuto, and the anonymous reviewers for their assistance. We determined the order of authorship that appears above by a flip of a coin.

Our analysis focused on technological factors, building upon previous research in transaction cost economics, international strategy, and organization theory. We examined the interrelationships among form of governance, two technological factors, and parent size for a number of U.S.-Japanese cooperations announced during the three-year period from 1984 to 1986. The technological factors investigated were technological intensity as measured by the ratio between R&D expenditures and sales for the product area of the alliance and intent to conduct joint R&D. We emphasized technological factors because they are theoretically important, help link apparently divergent theoretical perspectives, and are likely to play an increasingly important role in the future formation and forms of international cooperations (Doz, 1988; Dunning, 1988). Many of the alliances made between firms with headquarters in developed nations are in high-tech areas, and many also involve joint research and development (Auster, 1986; Hladik, 1988).

GOVERNANCE FORMS AND TRANSACTION COSTS

Research in transaction cost economics, international strategy, and organization theory has addressed the development of efficient and effective governance forms for multinational cooperative efforts. According to Williamson's (1975) transaction cost perspective, balancing efficiency and protection leads firms to select a mix of hierarchies and markets to manage transactions. Market transactions, involving exchange between autonomous economic entities, frequently serve as efficient contracting modes. Their use may be hazardous or cumbersome, however, when information regarding circumstances relevant to an exchange is asymmetrically distributed between the parties or when contracts cannot adequately specify the parties' responses to changing conditions over the duration of the contract.

Given the proclivity of parties to behave opportunistically under ambiguous conditions and the high costs frequently associated with achieving information parity, the transaction costs of market exchanges may outweigh their benefits. Hierarchical internal organization will become the preferred operating mode under conditions of substantial uncertainty and complexity (Jones, 1983; Williamson, 1975).

Under transaction cost theory, incentives to exploit information differences opportunistically shrink when the parties place transactions in a single hierarchy. Further, such internal organization may enhance information coding, the convergence of expectations, and auditing control, though at greater costs than when price alone can moderate the exchange between parties (Williamson, 1975).

Agreements as Quasi-Markets and Joint Ventures as Quasi-Hierarchies

Full internalization of interfirm transactions through acquisition is, of course, not the only alternative to market-based modes of governance. As several writers have noted, firms may use a wide range of transaction forms in implementing cooperative strategies (Anderson & Gatignon, 1986; Con-

tractor & Lorange, 1988). Following the analysis of Thorelli (1986), we separated various forms of cooperation into market-dominated and hierarchically dominated forms.

Contractual agreements to sell or provide technology, products, or services (e.g., supply and licensing agreements) are market-dominated. Joint ventures, on the other hand, can be seen as quasi-hierarchies.[1] We defined a joint venture as a new legal entity with full status as a corporate entity in which both parents share equity (cf. Auster, 1987; Killing, 1988; Osborn, Hunt, & Jauch, 1980).

Joint ventures provide joint ownership and control over the use and fruits of assets (Kogut & Singh, 1988). They may be used to bypass market inefficiencies. Equity control and both parties' sharing in the profits or losses attained through the venture's performance serve to align the interests of the parent firms, reducing the opportunism that may arise in contractual agreements (Hennart, 1988; Stuckey, 1983). Complete ex ante specification of ongoing activities and behavior requirements is therefore not required (Kogut, 1988). The joint venture form may also allow for a superior monitoring mechanism, since joint venture owners may be legally entitled to independently verified financial information as well as to information acquired through direct observation.

Though a joint venture does represent a partial internalization, it does not involve complete pooling of the parent's profit streams or the establishment of a single hierarchy. As Harrigan (1988) noted, shared ownership and shared decision-making arrangements can be cumbersome to manage and may reduce the speed with which many actions in pursuit of global strategies can be taken. Although the parties can renegotiate the provisions of both contractual agreements and joint ventures at any time, a joint venture is normally considered more difficult than a contractual agreement to establish, terminate, and fundamentally change (Harrigan, 1988). Finally, differences between home and host cultures in multinational joint ventures may amplify the effort and time required to build a common hierarchy that bridges the gaps in partners' cultural, linguistic, and organizational traditions (Anderson & Gatignon, 1986; Hayashi, 1987; Moroi & Itami, 1987; Zimmerman, 1985).

In short, joint ventures may offer some potential for protection and control, but at substantial administrative costs. The time and costs involved in developing multiparty equity arrangements coupled with the need for give-and-take in jointly managed ventures gives the joint venture form of governance less strategic flexibility than less binding forms of cooperation offer (Harrigan, 1988).

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[1] As several researchers have noted, a joint venture is both legally and conceptually different from a minority equity participation investment, in which a firm invests directly into a second company (Killing, 1988; Kogut & Singh, 1988). We discuss minority equity investments later in this article.

OPTIMIZING RELATIONS AMONG TRANSACTION, TECHNOLOGY, AND STRUCTURE

Jones (1987) extended the transaction cost perspective, explicitly incorporating technological factors. He argued that "the main imperative facing organizations is three pronged—they must simultaneously optimize the relationship among transactions, technology and structure" (1987: 214). We drew two themes for studying the interorganizational governance forms of international alliances from this interactive view.

Uncertainty, Control, and Governance Form

Several authors have suggested that the recent dramatic increase in multinational alliances represents the emergence of global strategies among firms responding to the internationalization of technological competence and markets (Geringer, 1988; Osborn & Baughn, 1987; Porter & Fuller, 1986). Technological globalization is particularly evident in rapidly advancing areas characterized by high R&D-to-sales ratios. In such technologically intense areas as pharmaceuticals, computers, and semiconductors, specific technical developments in products and processes are likely to come from Japan, North America, or Western Europe.

Uncertainty and control provide a conceptual link between technological intensity and the governance form chosen for an alliance. Technological intensity, as evidenced by a high R&D-to-sales ratio, is likely to reflect high uncertainty, which raises the transaction costs of market-dominated mechanisms. Facing higher costs for monitoring, enforcing, and regulating via market-dominated mechanisms, firms might be likely to select more hierarchical forms of alliance governance as technological intensity increases (cf. Jones, 1987; Williamson, 1985).

In technologically intensive areas, firms are likely to be particularly concerned about control of proprietary knowledge, products, and services. The classic problem of information valuation through market mechanisms may also enhance a preference for transaction forms providing high control. Agreeing upon a price for information is problematic unless a buyer knows what the information is—yet once that knowledge is disclosed, the buyer need not pay for it (Anderson & Gatignon, 1986; Calvet, 1981).

Such arguments explain the relationships that researchers have found between research and development expenditures and a preference for wholly owned subsidiaries over joint ventures (Stopford & Wells, 1972). The quasi-hierarchical joint venture form does not appear to provide the protection and control attributed to complete internalization. In extending this argument to the choice between the joint venture form and nonequity forms of cooperation, we might assume that quasi-market arrangements would be the least preferred mode of transaction in technologically intensive product areas.

However, firms may prefer arms-length contractual agreements. They may use them to control what information is shared, to reduce the chance

that knowledge transfer will exceed the scope intended by the parents, and to build interfirm trust before the parties undertake more involved activities (Killing, 1988). Another line of inquiry also suggested that firms forming alliances in technologically intensive areas might prefer agreements.

Technological Positioning and Governance Form

Several investigations of rapidly evolving technological areas have suggested that a key factor for a firm's survival is its positioning within a successful network of suppliers, manufacturers, and distributors. Agreements may be preferable to joint ventures for establishing such an initial position in a new technological area.

In high-tech areas, institutional and interorganizational infrastructures are often poorly developed, likely to change frequently, and particularly weak across national boundaries (Van de Ven & Poole, 1989). Early in the development of new products, several feasible designs with various degrees of governmental support from different nations often compete. Such is currently the case with high resolution TV and such was the case with nuclear power and video cassette players. In such areas, knowledge develops rapidly as various firms move to commercialization, consider entering an area, or merely seek to monitor the development of a technology. In short, firms may be seeking to position themselves. They may still be deciding what portions of the technology to keep, whom they will use as suppliers, and how they might successfully market new products (Skinner, Donnelly, & Ivancevich, 1987; Walker & Weber, 1987). Thus, firms may seek to establish or tap institutional and interorganizational infrastructures and become viable members of a winning network of organizations (Garud & Van de Ven, 1987; Van de Ven & Pool, 1989). Only as a technology stabilizes and it becomes clear that an alliance might be an important source of revenue might firms quasi-internalize such an arrangement through an equity relationship.

In high-tech areas, firms may generate numerous technical spin-offs, many of which are not crucial to their viability. Not all can be commercialized via equity investments. Such spin-offs may also facilitate the eventual establishment of an industry standard by spreading core technological features across apparently diverse products.

Given the need for flexibility as well as the limited ability of a joint venture to protect a partner's technology, it would seem that involvement in high-technology areas would limit the feasibility of selecting quasi-hierarchical structures as governance forms. Thus,

> *Hypothesis 1: To the extent that a cooperative alliance involves areas with high R&D intensity, agreements are more likely than a joint venture to be the chosen form of governance.*

Decisions to Engage in Joint R&D

Although quasi-hierarchies like joint ventures may be expensive and time-consuming to develop and may provide only limited protection from

exploitation, firms still may prefer them when facing the technological uncertainty associated with joint research and development. Technological commercialization often yields inseparable tasks that favor a hierarchy (cf. Maitland, Bryson, & Van de Ven, 1985). Market-mediated mechanisms may not provide adequate control over the myriad of complex judgmental tasks involved in R&D. In R&D efforts, individuals often need to interact to develop both new ideas and a special language for problem identification and problem solving (Osborn, Olson, & Hanada, 1985). In joint R&D, the knowledge being exchanged is not yet fully embodied in designs and specifications but embedded in the experience and skills of people—it is what Polanyi (1958) termed tacit knowledge. Further, information asymmetries may well arise during the R&D process itself, reducing the ability of an a priori agreement to capture the value of each partner's contributions adequately. Equity links increasing the internalization of a transaction would therefore appear to be preferable for transferring noncodified technological know-how (Hennart, 1988).

The decision to engage in joint R&D may also signal a commitment to a long-term relationship between parent firms. Participating firms are moving their joint relationship back up the value-added chain, taking longer to get a payoff and to build an effective organization. Developing new products and services may also allow even the largest multinationals to adjust their global strategies to incorporate the fruits of a joint venture (cf. Porter & Fuller, 1986).

> *Hypothesis 2: The intention to conduct joint R&D increases the probability that firms will adopt the joint venture form of governance for an alliance rather than agreements.*

PARENT SIZE

Organizational size is another of the many other factors we would expect to influence the establishment and form of multinational alliances (Dunning, 1988; Kogut & Singh, 1988; Osborn et al., 1980; Porter & Fuller, 1986). Unfortunately, the theoretical meaning of size remains elusive as various researchers have interpreted it in quite different ways (cf. Kimberly, 1976). Size also remains outside the theoretical specifications of transaction cost economics. For instance, Jones (1987) questioned whether large organizations might be able to buffer themselves from specific transaction cost requirements, yet he did not incorporate size into transaction cost theory.

Organizational size can be tied to opportunism. Very large organizations may be comparatively invulnerable: With abundant slack resources, multiple technical cores, the ability to retaliate against incursions, alone or in cooperation with government, and a vested interest in protecting its reputation, a very large organization may be less concerned than a smaller firm with a potential partner's possible exploitation (Doz, 1988). Thus, the specific technological factors underlying a cooperation might not receive the

same consideration that a smaller firm would accord them. Research on global strategy has suggested that large multinationals will or should be more concerned with global strategic positioning than with the transaction costs associated with any one alliance or the tactical adjustments in form stemming from technological factors (e.g., Porter & Fuller, 1986). Several other analyses have suggested that who a large multinational links with may be more important than how the link is made (see Geringer, 1988, for a review).

Work in organization theory dating back to Blau (1970) and Blau and Schoenherr (1971) has strongly suggested that the structures of very large firms may not reflect the importance of technological factors. More recently, writers such as Hannan and Freeman (1984) and Astley (1985) have also pointed to the intransigence associated with very large organizational size. If internal structures do not vary much with technological factors for very large organizations, the structural forms adopted for multinational alliances might be similarly resistant.

Whether very large size is seen as evidence of invulnerability, a global strategy, or bureaucratic intransigence, one point is clear. The governance form of a cooperative alliance needs to satisfy both parties involved. If only one or neither one of the parties is a very large multinational, vulnerability to exploitation may exist and the economic effectiveness of the transaction itself may be deemed critical. That is, an alliance is more likely to represent a key element in a parent's overall strategy when the parent is not extremely large. In such cases, the interplay among technological factors may be quite important (Jones, 1987). For instance, a comparatively vulnerable, small firm entering a high-tech cooperation in which joint R&D is planned places its sole technical core at risk and may need the expensive protection of the joint venture form. But when such a firm is not intending to conduct joint R&D it may well attempt to protect its technical core by using the quasi-market form to control what information is to be shared (Doz, 1988; Harrigan, 1985). Conversely, if both firms are very large multinationals, the interplay among technological factors may be less important. Thus,

> *Hypothesis 3: Parent size interacts with technological factors in determining the form of governance firms choose for a cooperative alliance. When both parents are large multinationals, technological factors will be less strongly related to the form the alliance takes than they will be when neither or only one is large.*

ALLIANCES, MEASURES, AND STATISTICAL ANALYSES

To examine the hypotheses stated above, we identified 270 new cooperative industrial arrangements between U.S. and Japanese firms announced in the *Asian Wall Street Journal* and the *Japanese Economic Journal* during the 1984–86 period. This group did not include alliances involving government agencies or universities. The overwhelming majority (248) involved

two parent firms. We eliminated alliances involving more than two parents as well as cooperations involving banking firms and trading companies. We did not formally include 22 arrangements that involved equity purchases by one parent in the other in the statistical analysis but reviewed them separately. Table 1 provides some descriptive information on the alliances studied, 153 two-party arrangements with industrial sponsors for which R&D data regarding the product of the arrangement were available.

An alliance was coded as a joint venture when its announcement indicated that the parents had formed a new legal entity with equity contributions. Of the 153 arrangements, 63 (41%) were of this form (see Table 2). We coded informal arrangements, cooperative ties, developmental assistance programs, licensing arrangements, and marketing and supply arrangements as agreements.[2]

A cooperation was considered as involving large firms when its consolidated total assets were greater than one billion dollars for the U.S. firm and one hundred billion yen for the Japanese firm. We took data on the parents' consolidated total assets from *Moody's Industrial Manual* (Moody's Investors Service, 1984, 1985, 1986) and the *Million Dollar Directory* (Dun's Marketing Services, 1986) for U.S. firms and from the *Japan Company Handbook* (Toyo Keizai Shinposha, 1984, 1985, 1986) for Japanese corporations. Although the monetary cutoffs were obviously arbitrary, we felt confident that firms of this size were large enough to have the capabilities and be subject to the constraints of very large firms discussed earlier. Nearly half (46%) the alliances involved two large firms.

The technological intensity of an alliance's product was measured as the average ratio of R&D to sales over the three-year study period for U.S. firms in industries producing that product. We took this average from information published in *Business Week* (1985, 1986, 1987), which was based on COMPUSTAT data from that period (see Table 1). Only U.S. data were used as U.S. and Japanese R&D data may not be directly comparable. The financial statements of Japanese firms, for example, do not report the Japanese government's subsidizing of substantial proportions of R&D costs for designated projects nor that government's expenditures for technology transfer (Harrigan, 1985).

Evidence of an intention to conduct joint R&D was taken directly from the announcements in the *Asian Wall Street Journal* and *Japanese Economic*

[2] Although the published tracking of announced alliances for this time period may be far from complete, the characteristics of the firms studied appear to be consistent with those given in other published data. Auster's (1986) report on U.S.-Japanese alliances, which she based on Japan External Trade Organization data, for example, shows a similar breakdown by industry and a similarly substantial proportion of alliances (46%) in high-tech industries. Both Hladik's (1988) work on international joint R&D and Takeuchi's (1988) survey of international cooperations involving Japanese firms reported that about 20 percent of the alliances involved an intent to conduct joint R&D. Finally, Auster's (1987) finding that in recent years joint ventures have accounted for between 20 and 50 percent of international cooperative linkages is consistent with data reported in Table 2.

TABLE 1
Characteristics of the Multinational Alliances Studied[a]

Industry or Technology[b]	Frequency	Percentage	Ratio of R&D Expenditures to Sales[c]
Steel	4	2.6	0.5
Textile-apparel	2	1.3	0.8
Food-beverage	4	2.6	0.9
Metals-metal products	10	6.5	1.5
Appliances	4	2.6	1.6
Auto parts	14	9.2	1.9
Tires-rubber	2	1.3	2.5
Miscellaneous manufacturing	5	3.3	2.7
Machines-industrial parts	12	7.8	3.1
Automotive	10	6.5	3.5
Chemicals	19	12.4	3.6
Electronics	7	4.6	4.4
Telecommunications	8	5.2	4.4
Aerospace	2	1.3	4.5
Precision equipment	14	9.2	6.4
Pharmaceuticals	4	2.6	7.6
Computers	19	12.4	7.8
Software	3	2.0	7.9
Semiconductors	10	6.5	10.4

[a] All the alliances studied were between U.S. and Japanese firms. Each involved two industrial firms. The study period was 1984–86. $N = 153$.

[b] The industry or technology areas were derived from the "R&D Scoreboard" of *Business Week* (1985–87).

[c] Percentages shown are three-year averages.

Journal: we simply coded the intention as present if an announcement mentioned it and as absent if it was not mentioned. About 1 in 5 (18%) of the alliances announced such an intent (Table 2).

The strategy literature suggests that industry conditions may alter preferences for various forms and types of strategic alliances (Ghoshal, 1987; Harrigan, 1988; Porter & Fuller, 1986). Industry-specific approaches to the introduction of new products and processes and differences in the attractiveness of innovation in different industries may alter the impact of technological considerations on the forms agreements take. Industry differences appear to have led to idiosyncratic findings in past organizational research (e.g., Hitt, Ireland, & Goryunov, 1988). It seemed prudent to control for basic industry type. We therefore included the categorical classification of industry type Hitt and colleagues (1988) employed as a control, classifying alliances on the basis of their product. The categories used were: (1) consumer durable goods, (2) consumer nondurable goods, (3) capital goods, and (4) producer goods.

Discriminant function analysis was used to predict the categorical criterion via a series of dichotomous and interval-level predictors (Dillon & Goldstein, 1984). To assess the importance of the technological and size

TABLE 2
Characteristics of Variables and Intercorrelations[a]

Variables[b]	Mean or Proportion	s.d.	Intercorrelations[c]			
			1	2	3	4
1. Form of alliance	0.41	0.49				
2. Technological intensity	4.48	2.71	−.21			
3. Joint R&D	0.18	0.38	.20	.21		
4. Firm sizes	0.46	0.50	.00	−.17	−.12	
5. Consumer durables	0.26	0.44	−.14	.23	.00	.08
6. Consumer nondurables	0.08	0.28	.03	.02	.04	.04
7. Capital goods	0.56	0.50	−.04	.01	−.01	−.09
8. Producer goods	0.09	0.29	.24	−.38	−.03	.07

[a] Coefficients not calculated are those among levels of a categorical variable. $N = 153$.

[b] These variables were dichotomously coded, allowing their means to be interpreted as proportions: for form, 0 = some form of agreement and 1 = a joint venture; for joint R&D, 1 = an announced intention to engage in joint R&D, 0 = no announcement; for firm sizes, 1 = both parties large, 0 = otherwise; and for the four industry membership variables, 1 = the association of an alliance's product with the given industry type, 0 = no such association.

[c] A correlation greater than or equal to .14 is needed to achieve significance at the .05 level. A correlation greater than or equal to .19 is needed to achieve significance at the .01 level.

variables over and above that of industry type, we first entered dummy variables representing the industrial categorization of an alliance into the equation and then noted the significance of the *F*-to-enter and the accompanying change in variance accounted for for each subsequent variable entered. Similarly, we entered cross-product terms involving the technological and size variables after including their constituent main effects. We chose to look at the significance of the partial *F*s rather than the standardized discriminant function weights as the weights themselves may have provided misleading information when the predictors were correlated (Dillon & Goldstein, 1984). Because we did wish to report the discriminant function weights as well, we conducted the analysis again using the residuals of the cross-product terms calculated by regressing the cross-product terms on their component effects. This procedure, which Lance (1988) suggested, does not affect the overall variance a prediction equation accounts for or any of the main or interaction effects—the *F*s-to-enter and their significance were identical to those obtained without using the residuals. Similarly, the discriminant loadings (structure coefficients) for the main effects remained unchanged. The discriminant function weights and the loadings for the interaction terms, however, more directly reflected the contribution of the variables used to classify the forms of alliances.

RESULTS

Table 2 presents the means, standard deviations, and bivariate intercorrelations among the variables used in these analyses. Since industry type was related to alliance form (Table 2), we retained it as a control.

As the data in Tables 2 and 3 show, both the technological intensity of an alliance's product area and the decision to engage in joint R&D were related to the governance form chosen for an alliance. In keeping with previous research on R&D, the intention to conduct joint R&D was somewhat more common as the technological intensity of an alliance's product area increased ($r = .21$, $p < .01$). Yet, as Hypothesis 1 predicted, agreements were the more common governance form in areas of high technological intensity ($r = -.21$, $p < .01$). The intention to conduct joint R&D was positively related to joint venture formation ($r = .20$, $p < .01$), as Hypothesis 2 predicted.

As noted above, there were 22 reported alliances involving one parent's buying equity in the other. Although there were too few of these to formally incorporate them into examination of the hypotheses, we conducted a revealing inspection of these arrangements. Half the minority equity participations involved joint R&D, versus only 11 percent of the agreements and 29 percent of the joint ventures. Again, firms chose a more elaborate governance form when conducting joint R&D.

The discriminant function model reported in Table 3 yielded a canonical correlation of .425 ($p < .01$), providing correct classification of 71 percent of the cooperative arrangements studied. As with the bivariate findings, both the technological intensity of the product of an alliance and the intention to engage in joint R&D added significant predicted variance; firm size did not.

TABLE 3
Results of Discriminant Analysis

Step	Variables[a]	*F*-to-Enter at Step	ΔR^2	Final Standardized Discriminant Weights	Final Discriminant Loadings
				.85	.29
1.	Industry categories	3.61*	.07	.81	.08
				.48	−.07
2.	Joint R&D (A)	7.33**	.04	−.63	−.45
3.	Technological intensity (B)	4.56*	.03	.45	.46
4.	Firm sizes (C)	0.00	.00	.00	−.01
5.	A × B	1.68	.01	−.28	−.23
6.	A × C	0.08	.00	−.05	−.03
7.	B × C	0.03	.00	−.05	.04
8.	A × B × C	5.49*	.03	.46	.36
Canonical correlation		.425**			
R^2		.18**			
Percent correctly classified		71.9			

[a] Weights and loadings for the industry categories reflect the contribution of the three dummy codes used for the four-group industry typology. Statistics shown for the interactions are residualized cross-product terms.

* $p < .05$

** $p < .01$

Although firm size did not interact with the independent effects of the technological factors in influencing governance form, it did interact with the combination of technological factors. The three-way interaction of technological intensity, joint R&D, and firm size did provide a statistically significant increase in the prediction equation (Table 3).

Subsequent analysis of the significant three-way interaction (not shown in a table) indicated that engagement in joint R&D in high-tech areas was associated with the joint venture form if at least one of the firms involved was not large. For the 70 alliances in this study involving two large firms, the two-way interaction of the technological intensity of the product and the intent to conduct joint R&D yielded an increase in R^2 of only .01 (n.s.). The increase in R^2 with the addition of this interaction for the 83 arrangements involving at least one smaller firm was .05 ($p < .05$). Thus, it appears that alliances involving at least one firm that is not a large multinational are especially sensitive to the interaction of high technology and joint R&D and are likely to employ the joint venture form of governance when those factors are present.

In summary, the results are consistent with Hypotheses 1 and 2. Hypothesis 3 was supported regarding the three-way interaction of firm size and the two technological predictors, but no significant two-way interactions emerged.

DISCUSSION

When considering the governance form to use for a multinational alliance, parent firms may face conflicting pressures as they move into high-technology areas where joint R&D tends to be common. Although the two measured technological factors were significantly intercorrelated ($r = .20$, $p < .01$), they were associated with different governance forms; high technological intensity with contractual agreements and the intention to conduct joint R&D with joint ventures.

Our findings are consistent with the technological positioning discussion leading to Hypothesis 1: contractual forms may not only provide the flexibility and multiple linkages considered so important in technologically intensive areas, but also help a firm limit the flow of proprietary information across boundaries. We argued that when joint R&D is present firms will prefer the joint venture form because it (1) facilitates information flows, (2) aligns the interests of the partners, reducing opportunism, and (3) provides for day-to-day coordination. Our information concerning a small number of minority equity participations in which one firm bought into its partner is also consistent with these arguments.

The importance of an alliance to its parent firms and its role in their overall strategies may be factors in resolving the conflicting pressures of the related technological factors. Many new high-tech alliances may be devices the partners are using for technological positioning. A decision to conduct joint R&D, however, may well signal a longer-term, more important commit-

ment to the viability of an alliance as an economic entity. Over time, the role and importance of the alliance may itself evolve as it becomes more or less important and the parents decide to use it for a different purpose. For instance, an agreement in a high-tech alliance initially used for technological positioning in a network could evolve into an important new business area involving production. Or an initial agreement might yield a consensus to pursue joint R&D. In both cases we predict that the probability of adopting the joint venture governance form will increase. As Harrigan (1988) suggested, cooperative arrangements may represent transitional stages in firm positioning. The governance form of an alliance is likely to change as the value of a particular activity to overall firm strategy changes.

The themes of purpose and importance may also be inferred from the interactive findings. Statistically, there was a triple-order interaction among technological intensity, intent to conduct R&D, and firm size in analyses predicting the form of governance. Although several interpretations of these findings are possible, given the various theoretical meanings researchers have attributed to size, we see the following.

In high-tech areas in which partners opt for joint R&D, it is clear that the joint venture form is preferred when neither or only one partner is a huge multinational. In such cases, it appears that the needs for control, coordination, and protection are particularly strong. The cooperation is important to its parents, and the economic success of the venture itself is likely to be important. For a small parent (worth less than a billion dollars), an alliance is likely to be a geographic diversification move centered on its technical core (presuming, as did Thompson, that smaller firms have only one or a few technical cores). The form of an alliance needs to reflect their requirements for conducting high-tech R&D or small firms will choose not to participate (cf. Jones, 1987).

When a cooperation involves two huge multibillion dollar multinationals, however, we see a more complex situation. Even their high-tech R&D alliances might not be central to one of their many technical cores, and the economic success of the alliance itself may not be the most important consideration. For multibillion dollar multinationals, high-tech R&D alliances might represent a geographic diversification that is not directly related to an existing core business. One or both partners could be exploring new areas or spinning off secondary uses of a new technology. Given the considerable potential market power combining two multibillion dollar multinationals can yield, merely establishing an alliance might take precedence over the technical or economic success of the venture itself. Merely establishing a cooperation with the ostensible intent of conducting R&D in a high-tech area may be sufficient to block competitors' entry into that area. Here, the role of the alliance may center on global network positioning to link potentially powerful firms.

In short, this research suggests that technological factors are important for examining multinational alliances, but not necessarily in the manner much current transaction cost theorizing has suggested. Although specific

technological dimensions may be correlated, their effects on form may be quite different. Further, the role and importance of an alliance may substantially moderate the collective influence of technological factors on governance forms. Here, parents' size could represent a number of potentially important aspects, such as intransigence, potential combined economic clout, and diversification strategies. In general, we expect that the less central a cooperative alliance is to a parent's core technology and the more that strategic placement in a network is a factor, the less will the initial form of governance used for the alliance reflect technological considerations. Of course, whether the match between technological considerations and governance form is associated with the success of an alliance is a question for future research.

These results also show the need for theoretical integration of the three research streams upon which we drew. Transaction cost theorizing needs to incorporate specific technological factors, and work on technological positioning could benefit from incorporating the economic constraints so dominant in transaction cost economics. Recognition of the conflicting pressures of specific technological factors and the role of corporate global strategy in alliance forms is also needed. Recognizing the technological aspects of interorganizational networks might help economists, strategists, and organizational theorists to both integrate their theoretical positions and begin to isolate the conditions under which theory-specific perspectives apply (cf. Dunning, 1988).

Threads for future research and theorizing concerning the governance forms and evolution of multinational quasi-markets and quasi-hierarchies would include directly measuring such potentially important factors as parents' diversification strategies, market power, and global strategic positioning in addition to measuring the technological factors emphasized here. Further explorations of the role and importance of alliances do indeed appear warranted, as increasing numbers of firms directly confront the challenge of global technological competence and global markets.

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